

impression of stars of the eleventh magnitude. And, in order to insure a reasonable limit of exposure for the chart plates, and to avoid any ambiguity which the employment of such a term as the fourteenth magnitude might produce, the Committee has further passed the following resolution :—

“The Committee indicates forty minutes as the duration of exposure for the negatives destined to form the chart, in the mean atmospheric conditions of Paris, and with plates prepared by the firm of Lumière, which are at present in use at Paris.

“The Commission mentioned above will forward to MM. Henry a screen, by means of which they will determine the time (t), expressed in minutes, required to form impressions of stars of the eleventh magnitude, starting from the ninth magnitude of Argelander. Then, for all observers who will be furnished with an identical screen, the ratio $\frac{40}{t}$ will be the factor by which the time

of exposure necessary to give the eleventh magnitude is to be multiplied, in order to obtain the stars of the feeblest magnitude for the chart.”

If the Congress had done nothing more than adopt these two resolutions, the meeting would have been justified. They not only render possible, but really insure, the execution of both the chart and the catalogue. In addition, however, much good work was done, both as concerns the method of measurement of the plates and the arrangements for effecting the meridian observations of the “*étoiles de repère*.” There is, too, left on their minutes this further important resolution :—

“Concerning the method of reproduction of the stars for the chart, only purely photographic processes shall be employed, to the exclusion of all other processes which demand the intervention of manual labour.”

The names of Captain Abney and M. Cornu are added to those of a previously existing Committee to settle the details of the process.

It is anticipated that the metallic screens will be distributed among the various Observatories in less than two months. In the meanwhile each Observatory is at liberty to proceed at once with the catalogue plates, care being taken that stars of the eleventh magnitude are impressed. In this sense, Admiral Mouchez's words are to be understood when he declared the work of the photographic chart of the sky commenced.

MAGNETIC ANOMALIES IN FRANCE.¹

By M. MASCART.

[Translation.]

THE first magnetic observations made in France by M. Moureaux, in 1884 and 1885, at not more than 80 stations, only enabled us to sketch the magnetic characteristics of the country in their broad features. Nevertheless, these first results were sufficient to detect certain anomalies, which are independent of the well-known irregularities which occur near rocks of volcanic origin, and which show no trace of the uniformity which is generally supposed to exist elsewhere. It was therefore necessary to multiply the stations in order to obtain a representation of the facts, which, if not absolutely correct, should be at least substantially accurate.

We therefore propose to cover France with a much closer network, which shall include about 600 stations properly distributed. Up to the present the north and the north-west, or, rather, the districts penetrated by the Chemins de Fer du Nord et de l'Ouest, are nearly completed, together with the region which extends south-

wards from Paris to the Loire. The number of stations is now over 200. The following is a description of the first results of these new investigations.

The map of the isogonal lines, in the district under consideration, discloses two principal anomalies, the one in Brittany, the other in the immediate neighbourhood of Paris. The first of these, discovered by M. Moureaux in the year 1886, has not as yet been fully studied. It is still necessary to observe at some points between Pontivy and Morlaix, and along the coast line between the mouth of the Loire and the bay of Douarnenez. Nevertheless, it is beyond question that a centre of disturbance exists near Pontivy, where the declination, which has been determined twice, with the interval of a year between the two observations, is less than at Ploërmel, which is 90 kilometres to the east. To the west of Pontivy, the isogonals are bent towards the north-west, and are drawn together near Morlaix. They next run south, or even south-south-east, thus roughly imitating the form of the coast-line of Brittany. It is possible that when the survey of this district is completed, the primitive rocks which occur in it will serve to explain the peculiarities which observation has brought to light. It is therefore unnecessary to discuss it fully at present.

The second anomalous region, however, is of special interest, on account of the nature of the soil. The attention of M. Moureaux was called to it by the results which he obtained at Chartres on June 22, 1889. Other observations, made both in this town itself and at various other places in the district, have confirmed the accuracy of the first measurements, and have led the observer to study the phenomena in detail in order to discover the magnitude and extent of the anomaly.

According to the provisional map of the true isogonals, the direction of the lines of equal declination only becomes approximately uniform towards the northern boundaries of France. Irregularities can be detected even in the latitude of Amiens, which extend as far as the Ardennes.

The isogonal of $15^{\circ} 20'$, which passed through Paris on January 1, 1890, instead of extending towards Orleans, bends to the south-south-east as far as Gien, then doubles suddenly on itself, running north-west to Houdan, which is west of Paris, and finally resumes a southerly course on the geographical meridian of Chartres. The isogonals, drawn for every $10'$ of declination, have all the same shape, from the English Channel as far south as the network of stations at present extends—that is, to near Cosne; and this conclusion is justified by a large number of concordant observations.

If the map of the true isogonals is compared with that in which the isogonals are assumed to be regular in form, we can deduce for every station the difference between observation and theory; and if the points where these quantities have the same value are connected, we obtain a map of the isanomalous curves of the declination.

A zone, corresponding to an excess of declination, extends on this map from the shores of the Channel (Dieppe) as far as the Loire (Cosne), and increases in intensity towards the south. The excess is $14'$ at Neufchâtel-en-Bray, $19'$ at Nantes, $24'$ at Chevreuse, $30'$ at Gien, and $36'$ at Cosne. The northern extremity of this zone extends towards the east to the neighbourhood of Laon, where the excess is still $7'$. Immediately to the west of this zone there is another, almost symmetrical with it, which corresponds, however, to declinations of less than normal value. Like the first, it increases in intensity towards the south. The discordance is $-6'$ near the mouth of the Seine, $-8'$ at Evreux, $-10'$ at Dreux, $-13'$ at Epernon, $-18'$ at Orleans. Thus, contrary to all expectation, the declination is less at Orleans than at Montargis and Gien, less at Epernon than at Paris.

The facts are consistent with the view that the north pole of the needle is attracted from both sides towards a line which passes through or near Fécamp, Elbeuf, Ram-

¹ This article is a *résumé* of a communication made by M. Mascart to the British Association at Leeds.

bouillet, and Châteauneuf-sur-Loire, making an angle of from 25° to 30° with the geographical meridian. The maps of the other elements also show effects along this line, viz. an increase in the dip, and a decrease in the horizontal force.

On comparing this anomaly with a geological map, we find that it extends exclusively over calcareous and cretaceous soils. In the region under consideration, the isogonals also present a regular deformation, which is not found over rocks of a kind to produce local effects on the compass. In the latter case the results are discordant, and it is seldom possible to represent them by curves. The totally unexpected phenomenon brought to light by this first series of observations seems due to some more general cause, the nature of which has yet to be determined. Before attempting an explanation, it will, no doubt, be necessary to study it more completely, and to extend the network of stations southwards. The irregularities in the isomagnetic lines which Messrs. Rücker and Thorpe have discovered in the south of England seem to be connected with those which M. Moureaux has observed in France.

ON A POSSIBLE CONNECTION BETWEEN THE RIDGE LINES OF MAGNETIC DISTURBANCE IN ENGLAND AND FRANCE. BY A. W. RÜCKER.

The possible connection between the French and English surveys, referred to by M. Mascart, can only be appreciated in view of facts which have been brought to light in the magnetic survey of the United Kingdom. It may therefore be desirable that a few lines should be added as to the phenomena observed on this side of the Channel.

The most salient feature in the magnetic constitution of the south of England is the existence of a ridge line (*i.e.* a line towards which the north end of the needle is attracted) the direction of which coincides generally with that of the Palæozoic axis. It runs through South Wales, passes thence to the valley of the Thames, and deviates to the south through Kent.

Near Reading the disturbance reaches a local maximum, and from this point a spur is thrown off, which passes due south to the Channel. In the maps which illustrate the magnetic survey of Dr. Thorpe and myself, it is shown entering the sea near to, but a little to the west of, Selsey Bill.

If the direction of the ridge line described by M. Mascart as passing through Rambouillet, Elbeuf, and Fécamp, be prolonged, it cuts the English coast near Portsmouth.

Putting aside, therefore, all other considerations, we may at the very least conclude that as the directions of the English and French ridge lines intersect in the Channel, they may possibly be connected. There are, however, various arguments which increase the probability of the connection.

We have traced in the United Kingdom two main ridge lines which run through districts covered by sedimentary rocks, and where, therefore, the source of attraction, if due to rocks, must be deep seated. In both cases the general directions of the lines remain unchanged for long distances.

A line, about 150 miles long, drawn from St. Bride's Bay to Kew would fairly represent the direction of the main magnetic ridge in the south.

Two lines, each 75 miles long, drawn from Wainfleet to Market Weighton, and from Market Weighton to Ribbleshead, would fairly represent the main features of the ridge line which runs from the Wash to South-east Yorkshire, and thence to Craven. They display, in fact, the same kind of continuity of direction as is shown by many mountain ranges. From Châteauneuf to Fécamp the ridge line follows an easy curve for 150 miles. The three most northerly stations lie nearly on a straight line

100 miles long, and it is quite in accord with what has been observed elsewhere that this general direction should be preserved for another 80 miles across the Channel. There are very similar magnetic indications that the Palæozoic axis extends across the Irish Channel, where it is 60 miles wide.

If this be so the direction of the French ridge alters when it approaches the English coast.

This might be expected. M. Moureaux finds that the magnetic disturbance diminishes as the latitude increases, and the disturbances in South Sussex and Hampshire are at all events not greater than those he finds in the north of France.

The declination disturbances at Neufchâtel-en-Bray and near the mouth of the Seine are $+14'$ and $-6'$ respectively; at Worthing and Ryde they are $+8'$ and $-10'$. When the line of the North Downs is passed, the phenomena are complicated by the meeting of the two lines of disturbance which run east and west and north and south respectively. That a locus of centres of attraction of diminishing intensity should be diverted by approach to another well-marked ridge line is *a priori* probable.

If, however, we take a further step, and attempt to seek a physical cause for the facts, it is noticeable that the English and French lines of disturbance meet a little to the east of the Isle of Wight, and almost in the prolongation of the great fault which traverses that island.

On the whole, there appears to be good reason to believe that the ridge line which is thrown off from the Palæozoic axis at Reading crosses the Channel, and is continued for 150 miles and for an unknown distance beyond into the heart of France. The magnitude of the declination disturbance at Cosne (the most southerly point to which it has been followed) is $36'$. This is greater than any disturbance hitherto observed in England, and is surpassed only by those obtained in Scotland and Ireland relatively near to basaltic rocks. The largest similar disturbances in England were found at Melton Mowbray and Loughborough, on good ground, but not far from the igneous rocks of Charnwood Forest. M. Moureaux's future investigations will, therefore, be followed with interest on this side of the Channel. Valuable evidence may be gained as to the causes of these disturbances when the clue he is following southwards has been followed to the end.

NOTES.

AT the next evening meeting of the Zoological Society, on Tuesday, May 5, a special conference on the fauna of British Central Africa will be held, in order to encourage the new Commissioner, Mr. H. H. Johnston, C.B., and his associates in their exploration of that country. The subject will be introduced by the Secretary, but many other members are expected to take part in the discussion. Mr. Johnston has already left for Nyassaland, but his naturalist, Mr. Alexander Whyte, and his Chief of the staff, Mr. B. L. Sclater, R.E., are expected to be present at the meeting.

AN important addition has been made to the Zoological Society's living collection in the shape of a fine adult specimen of the Lesser Orang (*Simia morio*) which has been received as a present from Commander Ernest Rason, R.N. The Lesser Orang was discriminated from the larger and more common form by Sir R. Owen as long ago as 1836, but this is the first example of it that has been acquired alive. It inhabits the swamps at the mouth of the Sarawak River in Borneo, where it is known to the natives as "*Mias Kassar*." An interesting account of its habits was sent home by the late Sir James Brooke in 1836, and was published in the Zoological Society's Proceedings for that year. The Lesser Orang is distinguishable from the